HORIBA

STEC Fluid Control Technology

Mass Flow Controllers

SEC-E series

SEC-E40 / E50 / E431X / E441X
E40MK3 / E50MK3

Mass flow controller SEC-E series controls flow rates from 10 sccm to 200 slm.

- Controls burner gas for industrial furnaces and heat treatment furnaces
- Controls gas in photovoltaic device manufacturing applications
- Controls atmospheric gases in a wide variety of chambers

High-speed response

Responds to a set flow rate within 1 second

High accuracy

± 1.0% F.S.

High reliability

Robust design also employs an automatic zero adjust function
(SEC-E40/E50/E40MK3/E50MK3)

SEC-E40

SEC-E50

SEC-E400X

Accurate, automatic control of gas flow rates - contributing to reducing production costs.

Basic model of Mass Flow Controllers and Meters

SEC-E40/E50/E431X/E441X
SEC-E40MK3/E50MK3

Series features

- **Accurate control of mass flow rates**

  The SEC-E series controllers measure the mass flow rate of a gas and control the rate according to a set flow rate sent as an electrical signal. Unlike volumetric measurement, if conditions such as temperature or pressure change there is no influence to the mass flow of the gas.

- **High-speed response: The flow set point is reached within one second (T98)**

  Equipped with new control circuits and a high-speed response flow rate sensor, the SEC-E series allows the flow rate of gas to reach a set flow rate, sent as an electric signal, within one second. A highly tuned PID function and robust design provide stable control of flow rates even in processes involving many flow changes.

- **Normally closed valve**

  A normally closed flow control valve is employed. It is closed when power is not supplied. This minimizes gas flow when the power supply is cut off.

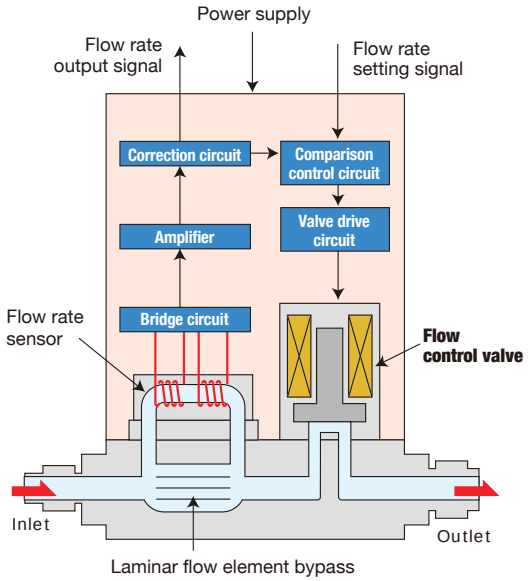
Major applications

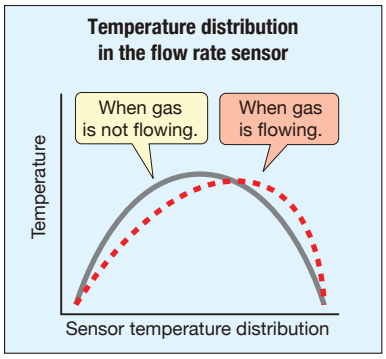
- Control of the flow rates of a wide range of burner gases including H_2, O_2, C_3H_8, CH_4, and Air
- Control of the flow rate of purge gas
- Control of the flow rate of laboratory equipment gases
- Flow control equipment where automation is required
- Equipment where flow volume is to be integrated, etc.

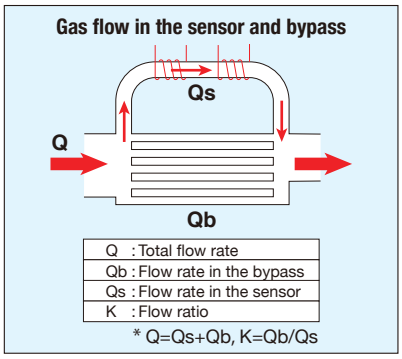
What is a Mass Flow Controller?

A mass flow controller automatically controls the flow rate of a gas according to a set flow rate sent as an electric signal, without being affected by use conditions or changes in gas pressure. Flow rates can be roughly classified into two types: volumetric flow and mass flow. A volumetric flow measurement is affected by ambient temperature and pressure. To see the true flow, the pressure and temperature conditions need to be measured and included in a calculation. Mass flow, on the other hand, measures the mass of a fluid so is influenced much less by temperature and pressure conditions, therefore providing much more accurate and stable flow measurement and control. Our mass flow controllers are used in a wide range of industrial fields as indispensable equipment when accurate control of flow rates is required or an automated production line is built.

■ Structure





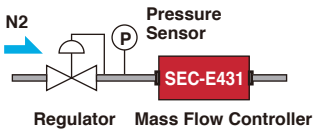


■ Operating principle

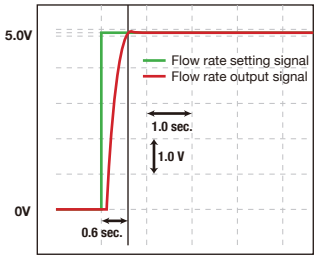
1. The gas, which enters from the inlet, first splits to flow past the sensor or through the bypass.
2. At the sensor, the mass flow rate is detected as a proportional change in temperature and converted by the bridge circuits to an electrical signal.
3. This signal passes through the amplification and correction circuits, and is output as a linear voltage between 0 to 5V. At the same time, it is also sent to the comparison control circuits.
4. The comparison control circuit compares the flow rate setting signal and the actual flow rate setting signal from the sensor and sends a difference signal to the valve driving circuit.
5. The flow rate control valve moves as appropriate to make the difference between the reguired flow set point and flow output signals approach zero. In other words, the unit controls the flow so that it is always at the set flow rate.

High-speed response to any set point

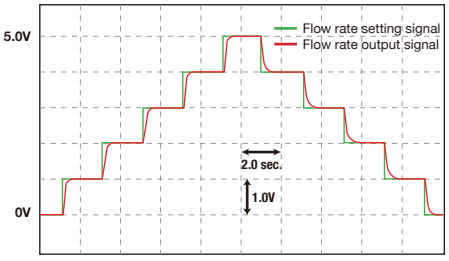
■ **Test flow**



Primary pressure : 150 kPa
Secondary pressure : Open to the atmosphere
Ambient temperature : 23°C
Model under test : SEC-E431
Specifications : N2 100SLM



Flow rate set points: 0%→100%



Flow rate set points : 0→20→40→60→80→100→80→60→40→20→0%

Specifications

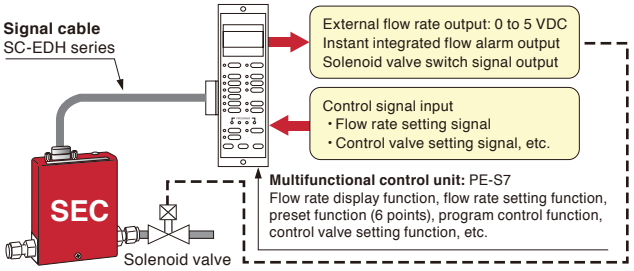
SEC-E series

Model	SEC- (Mass flow controller)	E40/E40MK3	E50/E50MK3	E431X	E441X
	SEF- (Mass flow meter)	E40	E50	E431X	E441X
Type of gas *1		Noncorrosive gases (MK3 can be used with N_2, O_2, Air, H_2, Ar, and He.)		N_2, O_2, Air, H_2, Ar, C_3H_8, CH_4, C_4H_{10}	
Wetted materials		SUS316, Fluorine rubber, PTFE, magnetic stainless steel			
Valve type		Closed when power off			
Standard flow rate range (N2 equivalent F.S.)		10/20/30/50/100/200/300/500 SCCM 1/2/3/5/10 SLM	20/30 SLM	50/100 SLM	200 SLM
Flow rate control range (SEC)		2～100% F.S.		5～100% F.S.	
Flow rate measuring range (SEF)		0～100% F.S.			
Response speed *2		≤ 1 second (T98)			
Accuracy		±1% F.S.			
Linearity		±0.5% F.S.			
Repeatability		±0.2% F.S.		±0.5% F.S.	
Operating differential pressure (SEC)		10 SCCM～5 SLM：50～300kPa (d) 10～30 SLM:100～300kPa (d)		100～300kPa (d)	200～350kPa (d)
Maximum operating pressure (SEF)		≤ 300 kPa (G)		≤ 350 kPa (G)	
Pressure resistance		≤ 1 MPa (G)			
Leak integrity *3		1×10^{-10} Pa・m^3/s (He) or below		1×10^{-9} Pa・m^3/s (He) or below	
Operating temperature		5 to 50°C (accuracy guaranteed: 15 to 35°C)		5 to 45°C (accuracy guaranteed: 15 to 35°C)	
Flow rate setting signal		0.1 to 5 VDC (input impedance: more than 1 MΩ)/2 to 100% F.S.		0.25 to 5 VDC (input impedance: more than 1 MΩ)/5 to 100% F.S.	
Flow rate output signal		0 to 5 VDC (minimum load resistance: 2 kΩ)			
Power supply		+15VDC ±5% 50mA −15VDC ±5% 150mA 3VA	+15VDC ±5% 50mA −15VDC ±5% 200mA 3.9VA		
Standard fitting *4		1/4 Swagelok type		3/8 Swagelok type	

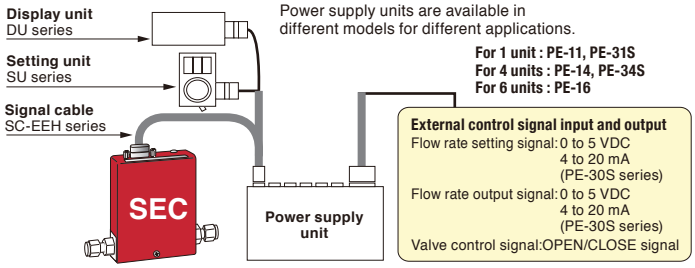
*1: For use of our mass flow controllers with gases other than those listed here, contact us. *2: Typical value *3: Mechanical leak (in conformity with SEMI standard)
*4: Non-standard joints can also be used. For more details, contact us.
※ The SEC-E40, SEC-E50, SEC-E40MK3, and SEC-E50MK3 have an automatic zero adjustment function.
※ Inlet pressure for the SEC-E40/ SEC-E50/ SEC-E40MK3/ SEC-E50MK3/ E431X: maximum 300 kPa (G) . For the SEC-E441X: maximum 350 kPa (G).
※ SCCM and SLM are symbols to represent flow rates (mL/min., L/min. at 0°C, 101.3 kPa).

Connection examples

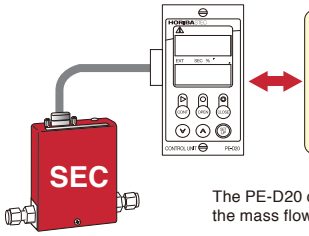
Using the PE-S7 multifunctional control unit is used



Using a power supply unit, a display unit, and a setting unit are used



Using the PE-D20 control unit is used



External control signal input and output
Flow rate setting signal : 0 to 5 VDC
Flow rate output signal : 0 to 5 VDC
Valve control signal : OPEN/CLOSE signal
Upper and lower flow rate limit alarm output : open connector output

The PE-D20 control unit has basic functions for controlling the mass flow controller.

Connector connection (mass flow controller / mass flow meter)

Connector signal table
Connector: D-Subminiature 9 contact pin connector
Plug: 17JE-13090-02 (D8B) (from DDK) and D-Sub connector (or equivalent) (mating screws from M3)

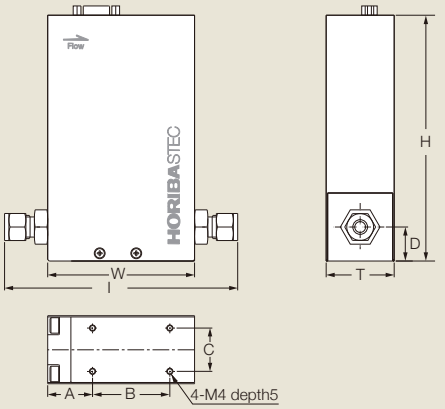
PIN No.	Signal name
1	Valve switch input *1
2	Flow rate output, 0 to 5 VDC (minimum load resistance: 2 kΩ)
3	Power supply, +15 VDC
4	Valve power supply COMMON *2
5	Power supply, -15 VDC
6	Setting input, 0 to 5 VDC *1 (input impedance: more than 1 MΩ)
7	Power supply, signal COMMON
8	–
9	N.C

*1 Not connected (N/C) for a mass flow meter. Ensure that the valve power supply COMMON terminal (pin No. 4) and the power supply and signal COMMON terminal (pin No.7) are wired separately but joined on the power supply side.

*2 Valve power supply COMMON need not be wired for a mass flow meter.

External dimensions

SEC-E40/E50/E431X/441X/E40MK3/E50MK3
SEF-E40/E50/E431X/441X



● List of external dimensions

SEC-E40/E50/E431X/E441X/E40MK3/E50MK3 **SEF-E40/E50/E431X/E441X**

Model	Joint type	H	T	W	I	A	B	C	D
SEC(SEF)-E40	Joint: 1/4 Swagelok type	126	32	76	127	3.5	69	18.5	12.75
SEC(SEF)-E50	Joint: 1/4 Swagelok type	126	32	76	127	3.5	69	18.5	12.75
SEC(SEF)-E431X	Joint: 3/8 Swagelok type	159	44	95	150.8	29	50	28	22
SEC(SEF)-E441X	Joint: 3/8 Swagelok type	159	44	95	150.8	29	50	28	22
SEC-E40MK3	Joint: 1/4 Swagelok type	126	32	76	127	3.5	69	18.5	12.75
SEC-E50MK3	Joint: 1/4 Swagelok type	126	32	76	127	3.5	69	18.5	12.75

Related product

High Flow Digital Mass Flow Controller

SEC-N170 Series

Maximum1000SLM (N2 equivalent)
(Flow rate range: 300/500/1000SLM)

Multiple Configulation Options

Analog communication
- 0-5VDC
- 0-10VDC
- 4-20mA

Digital communication
- RS485
- DeviceNet™
- CC-Link™
- PROFIBUS™

Accessories

Multifunctional control unit : PE-S7 (Complies with all RoHS regulations)

In addition to functions necessary to control mass flow controllers, this control unit has various functions such as a program control function and an alarm function.

- Multi-range solution
- Flow rate setting function/preset
- Integration function
- Program control function
- Instant integrated flow alarm output
- Software slow start function
- Flow rate valve switch function: fully open/ fully closed/ control
- Flow rate / Setting rate display function: SET/OUT coinstantaneous display
- Complies with the DIN standard

Power supply units : PE-10 and PE-30S (Complies with all RoHS regulations)

These power supply units provide a power supply for a mass flow controller (mass flow meter) and a display unit as well as reference voltage (5 VDC) for setting flow rates. These can be connected with signal cables and connectors.

PE-10 series
Can be used with all analog mass flow controllers (massflow meters)
PE-11: For 1 unit, PE-14: For 4 units, PE-16: For 6 units

PE-30S series
Can be used with all mass flow controllers (mass flow meters)
Power supply units of this series have a current control function (4 to 20 mA) as an additional function and can be used with a wide range of external control devices.
These also have functions for setting upper and lower flow rate limits and outputting alarms. PE-31S: For 1 unit, PE-34S: For 4 units

* We will advise on appropriate power supply units for your applications.

Control units : PE-D10/D20 (Complies with all RoHS regulations)

In addition to functions necessary to control mass flow controllers, these control units have various functions such as an alarm function.

PE-D10: Can be used with mass flow meters of the SEF series
PE-D20: Can be used with mass flow controllers of the SEC series
- Flow rate setting function
- Flow rate alarm function
- Flow rate control valve switch function: fully open, fully close, and control
- Flow rate / Setting rate display function: SET/OUT coinstantaneous display

Display units : DU-103K/102E (Complies with all RoHS regulations)

These display units display flow rate output signals from a mass flow controller (mass flow meter). By setting a full-scale flow rate, the actual flow rate can be displayed directly.

DU-103K: Compact type
DU-102E: Standard type

Setting units : SU-503ED/502EA (Complies with all RoHS regulations)

These setting units can be used to set a flow rate for a mass flow controller.

SU-502EA: Analog display type
SU-503ED: Digital display type

Signal cables for the SC-E series (Complies with all RoHS regulations)

These signal cables are required to connect various control units to a mass flow controller (mass flow meter).

SC-EDH type: Connection cable for control units (PE-S7/PE-D10, D20)
SC-EEH type: Connection cable for a power supply unit, a display unit, and a setting unit

* Cable length: Available in 1/ 2/ 3/ 5/ 10 m.

RoHS regulations : RoHS standards for "Restriction of Hazardous Substances"and is a set of regulations enforced in the EU to limit the use of six hazardous substances (lead, mercury, cadmium, hexavalent chromium, polybrominated biphenyls (PBBs) and polybrominated diphenyls (PBDEs)), in electric and electronic components.

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Please read the operation manual before using this product to ensure safe and proper handling of the product.

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